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Comparison of the influence of heat-treatment and cold-treatment treatments associated with kinesitherapy on the functioning of patients with gonarthrosis

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Abstract

The aim of this study was to compare the effects of rehabilitation in people burdened with osteoarthritis of the knee after using active exercises in the relief associated with the physiotherapy - mud containing minerals (fango) or local cryotherapy.
Studies were conducted in two groups before and after a ten-day improvement period. The assessment was based on the subjective perceptions of the VAS participants as well as completed questionnaires.
In the assessment of the objective range of mobility of knee joints, angular measurements of flexion and straightening of the joint, as well as the "Get up" test were performer to check the overall motor efficiency of the patients.
The results of the study have shown that the use of appropriately selected physiotherapy in knee osteoarthritis significantly alleviates pain and improves the overall condition of patients suffe ring from this condition.

Introduction

During the whole life, the human body is exposed to various types of load, related to the physiological need of movement, improvement of mobility or requirements resulting from the profession. To date, no method has been found to prevent premature joint wear. In the case of many people, complaints from the musculoskeletal system are underestimated due to lack of time for treatment or diagnosis of the symptoms. This often leads to the aggregation of micro-injuries and overloads that occurred in the past, which did not give rise to disturbing feelings [61].

Everyone in their life experiences and will experience the sensation of joint pain, and they are the most important part of the movement system. The knee joint is the most vulnerable and the biggest pond of a human being. In most cases, it is he who is damaged because of his complicated construction. It does not change the fact that the knee plays an important role in human locomotion [13].

Degenerative disease belongs to a group of these diseases, whose risk increases with age. It occurs in over 50% of people over 65 and in 80% of people over 75 years of age. It is also perceived as a chronic process of destroying the proper structure of the joint, which damages its anatomy, and consequently impairs function and motor activity. This disease may be accompanied by pain as well as the formation of an inflammatory process in the synovium. [27,33]

In the treatment of degenerative disease pharmacological, non-pharmacological and surgical methods are used. [15,59,60]

The most common forms of physiotherapy used in conservative treatment of osteoarthritis include: kinesitherapy, physical therapy, manual therapy, and massage.

Aim

The aim of this study was to compare the effects of rehabilitation in people burdened with osteoarthritis of the knee after using active exercises in the relief associated with the physiotherapy - mud containing minerals (fango) or local cryotherapy.

Material and methods

The study included 80 patients (59 women and 21 men) aged 40-64 years rehabilitated at the Provincial Specialist Clinic due to degenerative changes in the knee joints. Patients were randomly divided into two equal groups. During the two weeks (with a break of Saturday and Sunday) of physiotherapy, the first group performed active exercises in the relief associated with local cryotherapy, while in the second group active exercises in relief were preceded by a mud containing minerals (fango) treatment on the knee area.

The patients of both groups completed questionnaires about the general condition and pain of the affected joint before the first treatment and on the last day of the procedure. In

addition, they were subjected to the "patterning ballast" and "Stand up and go" tests. Measurements of the ranges of flexion and extension of the knee joint were also performed before and after the treatment cycle using a goniometer and the subjective assessment of pain intensity according to the VAS scale was made.

Statistical methods

The statistical analysis of the collected material was carried out in the Statistica 13.1 package from StatSoft. Both parametric tests and nonparametric tests were used to analyze the variables. The choice of the parametric test was conditioned by the fulfillment of its basic assumptions such as the compatibility of the distributions of the variables tested with the normal distribution, which were verified by the Shapiro-Wilk test. For all numeric variables, descriptive statistics were calculated: average, median, minimum, maximum, general quartile, lower quartile and standard deviation. In order to assess intra-group variability in two populations, the Student's test for dependent variables or, alternatively, the nonparametric Wilcoxon-pairs order test was used. The analysis of variables having the character of qualitative data was carried out using the Pearson chi-square test. The statistical significance was assumed to be $p < 0.05$.

Results

Patients undergoing physiotherapy were much less likely to report that pain is felt almost all the time. Before full-time procedures, 27.5% (22) complained of pain, while after surgery only 11.25% (9). At the same time, after the rehabilitation, the number of people who suffered from pain only occasionally from 30% to 46.25% increased. The difference was statistically significant.

Table 1. Frequency of pain before rehabilitation and after rehabilitation.

Feeling of pain				
	Before rehabilitation		After rehabilitation	
Occasionally	24	30,00%	37	46,25%
Often	34	42,50%	34	42,50%
Almost all the time	22	27,50%	9	11,25%
Total	80	100,00%	80	100,00%
p	Z=3,80 p<0,001			

Z - Wilcoxon pair order test result, p - level of probability.

Another ailment which in the course of the analysis turned out to be significantly

different in the examined patients in both groups before and after the procedures of the rehabilitation series was the morning stiffness of the affected joint, which disappeared after the start-up. Before rehabilitation, 21.25% of patients observed high morning stiffness, while after surgery only 3.75% of respondents declared high morning stiffness of the affected joint. The frequency of responses also decreased, with the average stiffness from 38.75% to 27.50%. Both these categories of responses after the rehabilitation process appeared much less frequently, while the percentage of patients declaring low morning stiffness of the joint significantly increased. In this category of responses, there was a change from 22.50% to 48.75% of respondents. This difference was statistically significant.

Table 2. Presence of morning stiffness before rehabilitation and after rehabilitation.

Occurrence of morning stiffness in the affected joint				
	Before rehabilitation		After rehabilitation	
No	14	17,50%	16	20,00%
Yes, small	18	22,50%	39	48,75%
Yes, average	31	38,75%	22	27,50%
Yes, big	17	21,25%	3	3,75%
Total	80	100,00%	80	100,00%
p	Z=4,95 p<0,001			

Z - Wilcoxon pair order test result, p - level of probability.

After the fango and local cryotherapy treatments, the patients also had a statistically significant decrease in the need to take analgesics and anti-inflammatories. Only 7.5% (6) of patients after rehabilitation are still taking these medications on a daily basis, which means the decline in the popularity of this response in the ratio of 18.75% (15) of patients previously declaring such a necessity. The number of patients who take drugs 3-4 times a week increased from 16.25% (13) to 23.75% (19), and those who have to take them rarely from 42.50% (34) to 31 have decreased, 25% (25). And most importantly, the number of patients who do not have to reach for pharmacological help in the fight against pain also increased, because as many as 37.50% (30) of patients after the study declared such an answer in relation to the earlier 22.50% (18) of the respondents. Which means that 12 people could stop taking painkillers and / or anti-inflammatories as a result of the rehabilitation.

Table 3. The frequency of analgesics / anti-inflammatory rehabilitation before and after rehabilitation.

Frequency of taking analgesics / anti-inflammatory drugs				
	Before rehabilitation		After rehabilitation	
Every day	15	18,75%	6	7,50%
3-4 times a week	13	16,25%	19	23,75%
Ralery	34	42,50%	25	31,25%
At ll	18	22,50%	30	37,50%
Total	80	100,00%	80	100,00%
p	Z=3,60 p<0,001			

Z - Wilcoxon pair order test result, p - level of probability.

After the series of treatments, the number of people complaining of pain, crackling, swelling or instability of the joints also decreased from 67 to 57. The difference between the answers to this question before and after a series of improvement procedures was statistically significant.

Table 4. The occurrence of symptoms such as pain, crackling, instability or swelling of the joints before and after a series of improvement treatments.

The occurrence of symptoms such as: pain, crackling, instability or swelling of the joints				
	Before rehabilitation		After rehabilitation	
Yes	67	83,75%	57	71,25%
No	13	16,25%	23	28,75%
Total	80	100,00%	80	100,00%
p	Z=2,35, p=0,018			

Z - Wilcoxon pair order test result, p - level of probability.

In the case of angular measurements, the statistical dependence occurred when measuring knee joint flexion. The change can be traced on the basis of an increase in the average size of the bending 101,05º 103,55º to the right leg and the 103,93º 107,14º to the left leg.

Measurement of the extension in the knee joint in both the first and the second group did not show statistically significant differences.

Table 5. Angular measurements of bending of knee joint.

The first group - the knee flexion								
Angular measurements [º]	Descriptive statistics							
	n	x̄	Me	Min.	Max.	Q1	Q3	SD
RLL before rehabilitation	38	101,05	100	70	130	90	120	17,67
RLL after rehabilitation	38	103,55	100	70	130	90	120	17,2
p	Z=2,66 p=0,007							
LLL before rehabilitation	28	103,93	100	70	130	95	115	14,93
LLL after rehabilitation	28	107,14	100	70	130	100	120	15,18
p	Z=2,52 p=0,011							
The second group - the knee flexion								
Angular measurements [º]	Descriptive statistics							
	N	x̄	Me	Min.	Max.	Q1	Q3	SD
RLL before rehabilitation	31	97,1	90	70	120	90	110	12,96
RLL after rehabilitation	29	99,66	100	70	120	90	110	12,1
p	Z=1,6 p=0,108							
LLL before rehabilitation	28	99,64	100	70	120	90	110	12,01
LLL after rehabilitation	25	102,8	100	70	120	90	110	12,42
p	Z=1,6 p=0,108							

n - number of observations; x̄ - average arithmetic; Me - median; Min. - minimum; Max - maximum; Q1 - lower quartile; Q3 - upper quartile; SD - standard deviation; d - difference, Z - result test of Wilcoxon pairs order; p - level of probability, RLL - right lower limb, LLL - left lower limb.

The results of the "Stand Up and Go" test before and after the series of treatments in the first group showed a significant statistical dependence. Patients covered the distance of 3 meters on average by 1.33 seconds faster after the end of rehabilitation. Half of the patients under study passed this distance by 2 seconds less than before undergoing physiotherapy. The difference was statistically significant.

Table 6. The results of the test "Get up and go" before and after a series of rehabilitation treatments.

First group								
Get up and go test [s]	Descriptive statistics							
	n	x̄	Me	Min.	Max.	Q1	Q3	SD
Before rehabilitation	40	22,11	22	10	32	19	27	5,7
After rehabilitation	40	20,78	20	10	32	18	26	5,57
p	Z=4,93 p<0,001							
Second group								
Get up and go test [s]	Descriptive statistics							
	N	x̄	Me	Min.	Max.	Q1	Q3	SD
Before rehabilitation	40	20,23	21	10	29	19	24	4,39
After rehabilitation	39	19,44	19	10	29	18	22	4,12
p	Z=1,3 p=0,192							

n - number of observations; x̄ - average arithmetic; Me - median; Min. - minimum; Max - maximum; Q1 - lower quartile; Q3 - upper quartile; SD - standard deviation; d - difference, Z - result test of Wilcoxon pairs order; p - level of probability.

In the subjective assessment of the intensity of perceived pain measured with the VAS scale, the examined patients in both the first group and the second group after a series of treatments definitely declared a reduction in pain. In the case of the right lower limb, the improvement was on average 2.11 points on the scale, and in the case of the left lower limb, on average 2.07 points on the VAS scale. In half of the patients in both groups, the pain intensity was lower by 2 points. These changes were of statistically significant nature.

Table 7. Subjective assessment of pain intensity according to the VAS scale.

Pain intensity [VAS]	Descriptive statistics							
	n	x̄	Me	Min.	Max.	Q1	Q3	SD
RLL before rehabilitation	33	6,33	6,00	2,00	10,00	5,00	8,00	1,93
RLL after rehabilitation	32	4,22	4,00	1,00	8,00	3,00	6,00	2,09
p	Z=6,95 p<0,001							
LLL before rehabilitation	32	6,13	6,00	3,00	9,00	5,00	8,00	1,79
LLL after rehabilitation	32	4,06	4,00	0,00	8,00	2,50	6,00	1,90
p	Z=6,73 p<0,001							

n - number of observations; x̄ - average arithmetic; Me - median; Min. - minimum; Max - maximum; Q1 - lower quartile; Q3 - upper quartile; SD - standard deviation; d - difference, Z - result test of Wilcoxon pairs order; p - level of probability, RLL - right lower limb, LLL - left lower limb.

Discussion

The presented work describes the problem of osteoarthritis of the knee joints. Studies have been carried out to assess the effect of the effectiveness of two physiotherapeutic treatments of fango and local cryotherapy associated with exercises in relief, to improve the mobility of patients with gonarthrosis.

In own studies in a statistically significant way after outpatient treatment in patients, the need to take analgesic and anti-edema pharmacological drugs decreased. Only 6 people from the whole group of 80 subjects take these drugs every day and the number of patients who do not have to reach for them increases, because as many as 30 respondents after the study declared such an answer in relation to the previous 18. This means that as many as 12 respondents rehabilitation could have stopped taking painkillers.

In own studies, the change in angular measurements was observed on the basis of the increase in the average size of joint bends. In the study group with the fango procedure increased from 101.05 degrees to 103.55 degrees for the right lower limb and from 103.93 degrees to 107.14 degrees for the left lower limb. This was probably the result of the heat treatment, which improves the tissue elasticity and viscosity of the synovial fluid and thus

increases the range of mobility in the joints and as a result of strongly overheating action, relaxes the muscles, often contaminated in osteoarthritis of the knee joints. [19]

Similar results with the use of another peloid were obtained by Evcik, which showed a beneficial effect of poultices using peloid on the knee joints. As a result of peloid treatment, the joint function was improved and the knee pain was significantly reduced, and thus the quality of life of the subjects was improved. [40]

The results obtained by me in the case of using local cryotherapy treatments are different from the results obtained by other authors. In the conducted studies, there were no changes in the mobility of the knee after a series of cryotherapy treatments. Brirkner and co-authors, based on the theory of biochemical laws, stated that the temperature reached in tissues and the time that cells will be subjected to low temperature is very important. The cold muscle reaction is much greater than that of the skin. The cooling of the treated area causes temporary shrinkage of the blood vessels, followed by an increase in tissue temperature. The greater the cold, the higher the temperature in the tissues. After a few minutes, the place of cooling produces congestion, vasodilatation, which improves the metabolism, releases noradrenaline and better oxygenation of tissues. [41]

In the case of extension, the results obtained by me in both groups were not statistically significant. Similar results were obtained by Romanowski and co-authors, investigating the impact of local cryotherapy treatments on motor fitness in patients with degenerative knee joint changes. Goniometer measurements of the range of motion in the knee joint were performed, the movement of the active bend and extension were assessed, then the muscle strength measurement and the 50 meter walk test were performed. Improvement of function and efficiency, especially locomotion, has been achieved. The authors claim that this improvement was the result of the effect of analgesic and anti-edema effects, as well as the relaxation of muscles as a result of the action of cold. [51]

Obtained results of the "Stand Up and Go" test after the rehabilitation process in the group of subjects with fango treatments showed a significant statistical dependence. Half of the patients examined this distance by 2 seconds faster than before undergoing physiotherapy. In the group of local cryotherapy treatments one can also notice an average improvement in the measurement values, but this is not a statistically significant change. A similar study was carried out by Jezierski, assessing the impact of cryotherapy treatments on the patient's ability to overcome the appropriate distance. As a result of the research, he obtained a significant extension of the distance traveled by the patients. [53]

In the subjective assessment of pain intensity measured with the VAS scale, subjects in both the group of patients with the fango procedure and local cryotherapy, after a series of treatments declared a decisive reduction in pain. In half of the patients in both groups, the pain intensity was lower by 2 points in the VAS scale. Similarly to Łukowicz and co-authors who compared the effectiveness of impulsive short-wave diathermy and local cryotherapy in combination with kinesitherapy in patients with gonarthrosis. In both study groups, after ten days of therapy, a statistically significant effect on the reduction of pain symptoms according to the VAS scale and on the improvement of functional capacity was found. [47]

Conclusions

1) The use of fango and local cryotherapy in combination with exercise in relief are effective methods in the treatment of symptoms in the course of osteoarthritis of the knee joints.
2) The fango treatment and local cryotherapy combined with weight relief in the studied patient groups decreased the intensity of pain sensations occurring in the course of osteoarthritis of the knee joints.
3) The use of fango and local cryotherapy in combination with exercises in relief in the studied group of patients reduced the amount of analgesics and anti-inflammatory drugs taken in the course of osteoarthritis of the knee joints.

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